

I CLAIM:

1 **Claim 1.** A road block comprised of a bollard and appa-
2 tus for actuating the bollard mounted below the surface of a road-
3 way when in the retracted configuration, wherein the bollard can be
4 extended above the roadway surface for arresting vehicles, compris-
5 ing:

6 a foundation of reinforced cementitious material for
7 mounting the bollard apparatus below the roadway surface; said
8 bollard apparatus includes a stationary outermost anchor housing
9 and a removable coacting casing which reciprocatingly receives the
10 bollard therewithin, with said casing being removably supported
11 within said anchor housing; biasing means for storing energy and
12 connected to selectively expend the stored energy to lift said
13 bollard at a relatively slow rate of extension respective the
14 casing;

15 a double acting fluid actuated power lift having a fluid
16 actuated cylinder, with there being a power piston reciprocatingly
17 received within said cylinder and defining spaced upper and lower
18 chambers; said power piston being connected to actuate said bollard
19 between a retracted and an extended configuration responsive to a
20 pressure differential effected between said upper and lower cham-
21 bers;

22 valve means, including a flow line connecting a source of
23 power fluid to said upper and lower chambers for selectively intro-
24 ducing power fluid into said upper and lower chambers and for
25 selectively exhausting spent power fluid from said upper and lower
26 chambers, thereby controlling the pressure differential across said
27 power piston; whereby, the valve means, when selectively moved into
28 one operative position simultaneously applies power fluid to the
29 lower chamber while exhausting power fluid from the upper chamber
30 and thereby extending the bollard above the surface of the roadway,
31 and the valve means when selectively moved into a second operative
32 position simultaneously exhaust power fluid from the lower chamber
33 while applying power fluid to the upper chamber for retracting the
34 bollard; and circuitry means connected for sequentially or simulta-
35 neously operating the valve means to selectively rapidly or slowly
36 extend the bollard and to retract the bollard.

1 **Claim 2.** The bollard and apparatus of Claim 1, wherein
2 the biasing means is connected to provide an upward force between
3 the bollard and the casing by which the bollard is moved into the
4 extended configuration when the valve means is moved into an opera-
5 tive position to equalize the pressure between said upper and lower
6 chambers to slowly extend the bollard; said circuitry means in-

7 cludes switch means operatively connected to move the valve means
8 into a position which exhaust the upper chamber pressure and
9 thereby utilize the stored energy of the biasing means which slowly
10 extends the bollard from the coacting casing.

1 **Claim 3.** The bollard and apparatus of Claim 1 wherein
2 the biasing means is a spring having opposed ends connected to be
3 compressed between the bollard and the coacting casing and thereby
4 store energy to subsequently urge the bollard into the extended
5 position in response to the pressure differential across the power
6 piston reaching a value that is less than the force stored in the
7 spring; wherein said valve means is connected to apply power fluid
8 to said upper chamber to overcome the spring force in order to
9 retract the bollard.

1 **Claim 4.** The apparatus of Claim 1, wherein the valve
2 means is moved to a position to exhaust the upper chamber while
3 applying pressure to the lower chamber to extend the bollard at a
4 rate responsive to the magnitude of the pressure deferential im-
5 posed across the power piston.

1 **Claim 5.** The apparatus of Claim 4, and further including
2 vehicle speed detector means arranged to actuate the circuitry
3 means and to actuate the bollard into the extended position within
4 a time frame that intersects and arrests the traveling vehicle.

1 **Claim 6.** The bollard and apparatus of claim 1, and
2 further including abutment means formed between the bollard and the
3 casing for limiting the extension and retraction of the bollard;
4 the valve means being actuated by the circuitry means to reduce the
5 pressure within the upper chamber at the beginning of bollard
6 extension, and thereafter the valve means subsequently increases
7 the upper chamber pressure prior to the termination of the bollard
8 extension to thereby decelerate the bollard as the bollard nears
9 the end of its extension, and wherein the valve means reduces the
10 pressure within the upper chamber.

1 **Claim 7.** The apparatus of Claim 6, wherein the biasing
2 means is a spring having opposed ends connected to be compressed
3 between the bollard and the coacting casing and thereby urge the
4 bollard into the extended position in response to the pressure
5 differential across the power piston reaching a value that is less
6 than the spring force stored in the spring; and a centralizer
7 axially aligned with said bollard, said casing and said spring,

8 wherein one opposed marginal terminal end of the centralizer is
9 telescopingly received within the bollard and the coacting spring
10 with the other end of the centralizer being received within the
11 coacting casing.

1 **Claim 8.** The bollard and apparatus of Claim 1, wherein
2 the valve means is moved to a position to exhaust power fluid from
3 the upper chamber while applying power fluid pressure to the lower
4 chamber responsive to the circuitry means sensing the presence of
5 a speeding vehicle and for providing a signal for sequentially
6 operatively actuating the valve means into selected positions to
7 connect the power fluid to the appropriate upper and lower chambers
8 to rapidly extend the bollard, and thereafter to reverse the rela-
9 tionship of the fluid pressure imposed on the upper and lower
10 chambers to arrest the extending bollard whereby the bollard non-
11 destructively reaches the end of its travel.

1 **Claim 9.** The bollard and apparatus of Claim 8, wherein
2 there is further included a centralizer supported on said casing,
3 said biasing means is a spring slidably received about the upper
4 marginal end of the centralizer while the centralizer and spring

5 are telescopingly received within the coacting casing; said spring
6 is of a size to store energy therein that together with the power
7 lift means accelerates the bollard into an extended position.

1 **Claim 10.** A road block comprising a bollard apparatus
2 for stopping a vehicle traveling along a roadway leading to a
3 security area wherein the bollard is controlled to prevent intru-
4 sion of a vehicle possibly containing terrorists; the improvement
5 comprising:

6 said bollard apparatus being reciprocatingly received
7 within a removable casing, said casing being telescopingly received
8 within a fixed foundation outermost anchor housing, with the anchor
9 housing being embedded within a foundation of cementitious mate-
10 rial;

11 a centralizer having opposed ends; a power spring having
12 upper and lower opposed ends compressible towards each other for
13 storing energy, a power lift means having a piston connected to
14 reciprocate said bollard, said piston being reciprocatingly re-
15 ceived within and dividing the power lift means into upper and
16 lower chambers for extending and retracting said bollard responsive
17 to power fluid applied thereto;

18 valve means connected to selectively flow power fluid

19 from a source into and from said upper and lower chambers; spaced
20 abutments for limiting the extension and retraction of said boll-
21 lard;

22 one opposed end of said centralizer being supported
23 within and respective the casing with the other end of the centra-
24 lizer being received within the bollard, and a marginal end of the
25 spring being positioned within the bollard and the opposed marginal
26 end of the spring being received about the upper marginal end of
27 the centerlizer, and, a spring stop on said centralizer for com-
28 pressing one end of the spring; and with the power lift being
29 supported respective and within the centralizer;

30 the opposed ends of said spring being connected to be
31 compressed between the bollard and the centralizer to thereby store
32 energy to urge the bollard into the extended position in response
33 to the pressure differential across the power lift piston reaching
34 a value that is less than the force stored in the spring; and means
35 for applying power fluid to said upper chamber to overcome the
36 spring force and thereby retract the bollard from the extended into
37 the retracted position; and,

38 circuitry means and detector means operatively connected
39 to actuate said valve means to extend said bollard in response to
40 a vehicle accelerating at a predetermined rate of speed.

1 **Claim 11.** The improvement of Claim 10, wherein the power
2 spring is connected to provide an upward force between the bollard
3 and the removable casing by which the bollard is moved into the
4 extended configuration when the valve means is moved into a se-
5 lected operative position to thereby equalize the pressure between
6 said upper and lower chamber; and slowly extend the bollard; said
7 circuitry means includes switch means operatively connected to move
8 the valve means into a position which exhaust the upper chamber
9 pressure and thereby utilize the stored energy of the power spring
10 which slowly extends the bollard from the coacting casing.

1 **Claim 12.** The improvement of Claim 10, wherein the power
2 spring is a coiled spring having opposed ends connected to be
3 compressed between the bollard and the coacting casing and thereby
4 store energy to subsequently urge the bollard into the extended
5 position in response to the pressure differential across the piston
6 reaching a value that is less than the force stored in the power
7 spring; and means for applying power fluid to said upper chamber
8 to overcome the power spring force in order to retract the bollard.

1 **Claim 13.** The improvement of claim 10, and further
2 including speed detector means connected to actuate switch means
3 which in turn is connected to actuate said valve means; and wherein
4 the valve means is operable in response to the detector means that
5 electronically determine the rate of acceleration of an oncoming
6 vehicle and to actuate the bollard into the extended position
7 within a time frame that intersects and arrests the traveling
8 vehicle.

1 **Claim 14.** The improvement of Claim 10, and further
2 including abutment means for limiting the extension and retraction
3 of the bollard; the valve means being actuated by said switch means
4 to reduce the pressure within the upper chamber at the beginning of
5 bollard extension and the valve means subsequently increases the
6 upper chamber pressure prior to termination of the bollard exten-
7 sion to thereby decelerate the bollard as the bollard nears the end
8 of its extension; and, wherein the valve means reduces the pressure
9 within the upper chamber by connecting the upper chamber to exhaust
10 power fluid at the beginning of the bollard extension and thereaf-
11 ter the valve means connects the upper chamber to the power fluid
12 to decelerate and cushion the impact of the bollard against the
13 abutment means therefor.

1 **Claim 15.** Method of controlling flow of vehicular traf-
2 fic along a roadway, comprising the steps of:

3 step 1. providing a below grade foundation of
4 cementitious material having an upwardly opening chamber formed
5 therein that terminates near the surface of the roadway;

6 step 2. placing an anchor housing within said
7 chamber and attaching the anchor housing to the cementitious mate-
8 rial of the foundation whereby lateral and torsional forces imposed
9 on said anchor housing are transferred into the foundation;

10 step 3. reciprocatingly receiving a bollard within a
11 coacting casing and telescopingly installing said bollard and
12 coacting casing in axially aligned relationship within said anchor
13 housing in a removable manner such that the upper end of the bol-
14 lard bollard assembly terminates at the roadway surface when the
15 bollard is retracted;

16 step 4. extending and retracting said bollard by
17 the provision of a power operable lift means having a piston
18 reciprocatingly received within a power cylinder and coupled for
19 reciprocating said bollard into an extended and retracted configu-
20 ration respective said coacting casing, and further including the
21 step of slowly extending said bollard by using a biasing means
22 which overcomes the weight of said bollard by storing energy there-
23 in when retracted;

24 step 5. maintaining the bollard in the retracted
25 configuration by applying a downward force on said piston by
26 positioning a valve means to flow power fluid into the power lift
27 means and thereby exert sufficient downward force on the bollard to
28 overcome the energy stored in a biasing means.

1 **Claim 16.** The method of Claim 15, wherein the valve
2 means are positioned to continuously maintain a relatively small
3 pressure differential across the piston that is of a magnitude to
4 restrain the bollard in the retracted position when in the standby
5 configuration.

1 **Claim 17.** The method of Claim 16, and further including
2 the step of actuating said valve means to slowly extend the bollard
3 by using a switch means connected to move the valve means into a
4 position which reduces the pressure differential across said piston
5 to thereby release the stored energy of the biasing means which
6 slowly extends the bollard from the coacting casing.

1 **Claim 18.** The method of Claim 15, and further including
2 the steps of using a power spring as the biasing means and connect-
3 ing opposed ends of the spring to be compressed as the bollard is
4 retracted within the coacting casing and thereafter urging the
5 bollard towards the extended position in response to the pressure
6 differential across the piston reaching a value that is less than
7 the spring force stored in the spring.

1 **Claim 19.** The method of Claim 15, wherein the valve
2 means is moved to a selected operable position according to the
3 steps of:

4 step 6. providing a dictionary of stored terms
5 related to a profile of a vehicles' actions when operated by a
6 terrorist; wherein the profile includes the various actions ex-
7 pected of the vehicle during a period of time immediately prior to
8 the consummation of a mission;

9 step 7. providing a dictionary of stored terms related
10 to a profile of a vehicle operated by a law abiding citizen wherein
11 the profile includes the various actions expected of the vehicle
12 during normal driving conditions for the particular area involved;

13 step 8. measuring the velocity and acceleration of a
14 vehicle as it approaches a security area; and comparing the last
15 said stored data to the profile of step 1 and step 2 above; and,

16 Step 9. whenever said comparison of said vehicle profile
17 of step 3 with said dictionary of stored knowledge of step 1 and
18 step 2 indicates a critical situation is present, the extension of
19 the bollards commences with the on-coming vehicle being at a dis-
20 tance that provides sufficient time for the almost instantaneous
21 extension of the road block apparatus; whereby, the bollards of the
22 road block apparatus are fully extended simultaneously with or
23 before contact of the vehicle.

1 **Claim 20.** The method of Claim 19, wherein, after step 3
2 has been completed, should said comparison be inconclusive, the
3 road block of this disclosure is slowly actuated; whereby the
4 bollards of the roadblock are extended during a time interval that
5 enables the vehicle to decelerate prior to encountering the road-
6 block.